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## Canadian Patents Database

(12) Patent:

(54) RAM JET ENGINES

(54)

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ABSTRACT:

CLAIMS: [Show all claims](#)

\*\*\* Note: Data on abstracts and claims is shown in the official language in which it was submitted.

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(73) [Owners \(Country\):](#)

(71) [Applicants \(Country\):](#)

(74) [Agent:](#)

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**WHITNEY COLLINS (Not Available)**  
**CONTINENTAL AVIATION AND ENGINEERING CORPORATION**

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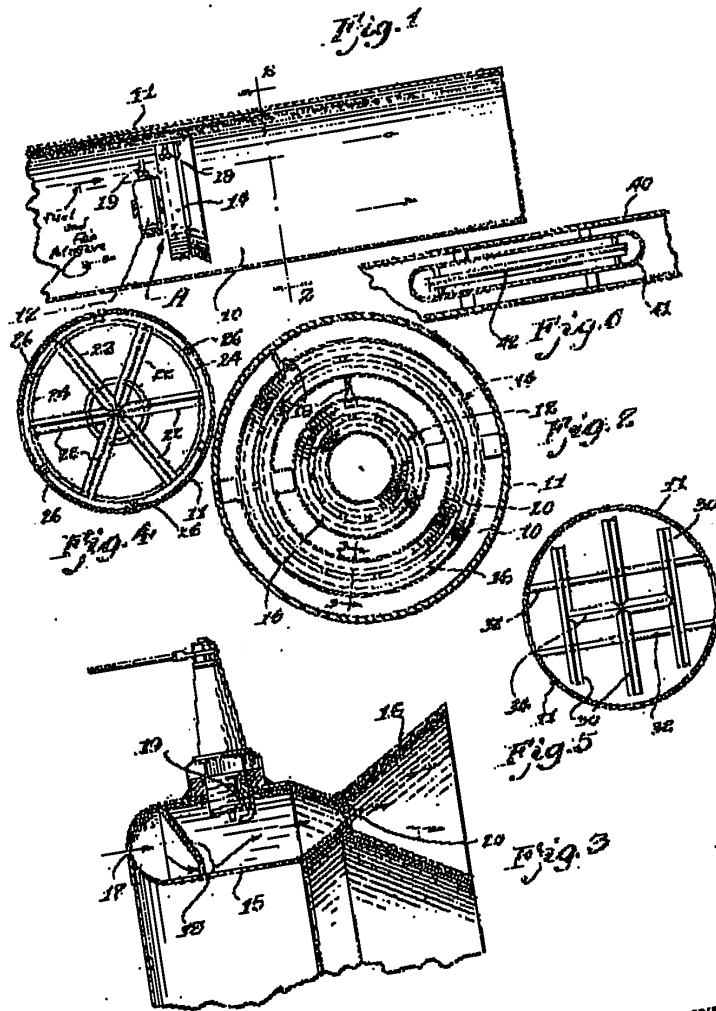
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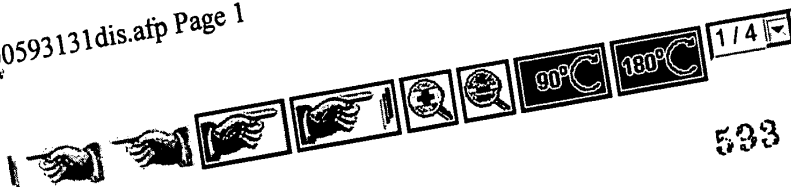
INVENTOR

W. COLLINS

PATENT AGENT

*Ridout & Mayhew*





593 131

- 2 -

This invention relates to ram jet engines and more particularly to combustion control and means for anchoring the flame in the high velocity air stream of a ram jet combustor.

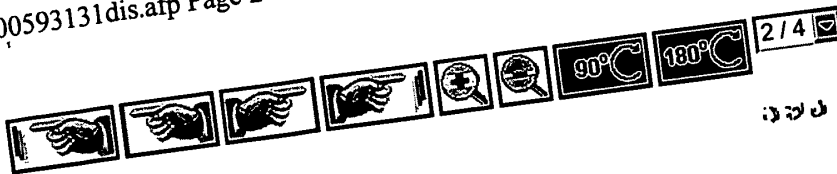
- 4 Many devices and experiments have been used in an attempt to hold the flame in ram jet combustors. Many such devices have been developed, and many have been quite successful, but room for improvement is quite evident to those skilled in such research. All seek to construct a device where the flame may be maintained under higher air flow velocity, lower pressures and under a wider range of fuel-air mixture conditions.

12 It is an object of the present invention to anchor the flame in the high velocity air stream of a ram jet combustor by constructing flame holder that is vastly improved in construction and operation over such devices as now known and used.

16 Other objects and advantages will be made evident as the description progresses, and for a more detailed understanding of the present invention, reference may be had to the accompanying drawing illustrating a preferred embodiment of the invention, wherein like parts refer to like parts throughout the several views, and in which

24 Fig. 1 is a longitudinal sectional view of the combustor of a ram jet engine and showing the present improved type of flame holder in elevation.

28 Fig. 2 is an enlarged transverse sectional view through a ram jet combustor taken substantially on the line 2-2 of Fig. 1.



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- 3 -

Fig. 4 is a transverse sectional view showing

FIG. 5 is a transverse sectional view showing a further modified construction, and

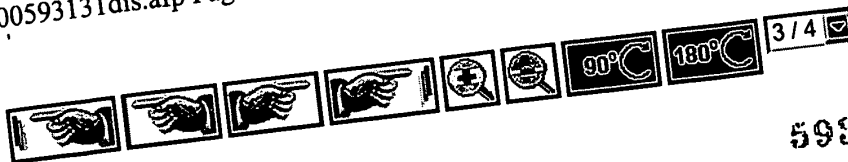
The present piloted-flame holder for a ram jet engine is illustrated as being secured or otherwise attached to the combustor 10, provided by the

engine is illustrated in Figure 10. The combustor 10, centrally supported in the combustion chamber 11, comprises inner and outer concentric flame holder rings 12 and 14 respectively, and is utilized as a means of anchoring the flame in the high velocity air stream flowing through the combustion chamber 10 in pipe 11.

It is believed to be practical in many applications to utilize

It is found to be practical in many cases to provide a plurality of such annular ring-like piloted flame holders. Fig. 5 illustrates in detail the cross section of one of these annular piloted flame holders, it being noted that both devices 12 and 14 are similar in detail, the flame holder 12 merely being constructed smaller in diameter than the holder 14. A description of one will suffice for a complete understanding of the invention.

The annular pilot 15 is attached to the vertex of a V-shaped gutter ring 16. Fuel is mixed with the air stream in pipe 11 upstream from the flame holder, and a small portion of this fuel and air mixture enters the opening 17 at the front end of the pilot. The velocity of the fuel mixture entering into the interior of the annular pilot ring is reduced before flowing around the baffle



593 131

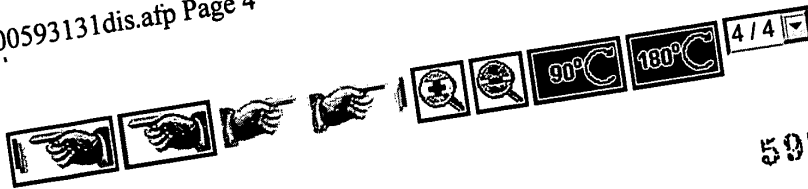
- 4 -

10 and 19 ignited by the spark produced by the spark plug 19. The flaming gases pass through the opening 20 in the end of the annular pilot ring into the sheltered region of the V-shaped gutter flame holder where the main stream of fuel and air is ignited and the flame anchored. The spark plug is utilized only to initially ignite the fuel and air mixture, after which the pilot flame is maintained behind the baffle and acts as a continuous source of flame over the entire periphery of the main flame holder.

The advantages of this unit are that it is not only initially ignites the high velocity stream of combustible mixture, but more significantly that it is instrumental in maintaining the flame on the flame holder under higher velocity, lower pressures, and a wider range of fuel-air mixture conditions than would otherwise be possible with the flame holder alone. At these critical velocities and pressures, where flame blowout would normally be imminent, the pilot furnishes a stream of flaming gases to the sheltered region behind the flame holder and thus maintains the burning.

While circular types of flame holders are desirable for any applications, this invention is by no means strictly limited to a circular construction. Figs. 4 to 6 inclusive illustrate other modified constructions. The V-shaped flame holders 22 of Fig. 4 may be of a radial construction joined together at the center and supported by an annular ring 24, which is in turn supported by brackets 26 or other suitable supports from the pipe 11. In Fig. 5, the flame holders 30 are disposed parallel in a plane normal to the axis of the pipe 11 and supported by the transverse braces or struts 32, and these parallel V-shaped troughs are preferably connected by a cross V-shaped gutter 34 to carry the flame from one flame holder to the other. In Fig. 6, the main jet 18

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593 131

- 2 -

constructed for assembly within an airplane wing structure 40 and comprises a flattened or transversely elongated pipe section 41 having a horizontally extending V-shaped flame holder 42 supported therein. The exhaust gases travel generally normal to the plane of the sectional view of Fig. 6 and are exhausted out of the trailing edge of the airplane wing structure.



593 131

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A piloted flame holder for a ram jet engine comprising a flame holder of V-shaped cross-section disposed in a plane normal to the fuel-air flow through said engine and having its vertex pointing upstream of said fuel-air flow, and pilot burner means disposed adjacent to the vertex end of said flame holder, said flame holder having an opening at its vertex, said pilot burner discharging a continuous flame into the said flame holder opening and into the sheltered zone in said flame holder, said pilot burner means comprising an annular combustion chamber having an intake opening on the upstream edge thereof and facing said fuel-air flow, baffle means within said combustion chamber to retard the velocity of the fuel and air mixture admitted thereto, the downstream edge of said burner secured to the upstream vertex edge of said flame holder, and ignition means in said burner to initiate combustion therein.





593 181

7

E. A piloted flame holder for a ram jet engine comprising an annular flame holder of V-shaped cross section disposed in a plane normal to the fuel-air flow through said engine and having its vertex pointing upstream of said fuel-air flow, and pilot burner means disposed adjacent to the vertex end of said flame holder, said flame holder having an opening at its vertex, said pilot burner discharging a continuous flame into the said flame holder opening and into the sheltered zone in said flame holder, said pilot burner means comprising an annular tubular ring having a fuel-air mixture intake opening on the upstream edge thereof and facing said fuel-air flow, baffle means within said tubular ring to retard the velocity of the fuel and air mixture admitted thereto, the downstream edge of said annular burner secured to the upstream vertex edge of said flame holder, and ignition means in said burner to initiate combustion therein.



593 131

5

8. A piloted flame holder for a ram jet engine comprising an annular flame holder of V-shaped cross section disposed in a plane normal to the fuel-air flow through said engine and having its vertex pointing upstream of said fuel-air flow, and pilot burner means disposed adjacent to the vertex end of said flame holder, said flame holder having an opening at its vertex, said pilot burner discharging a continuous flame into the said flame holder opening and into the sheltered zone in said flame holder, said pilot burner means comprising an annular tubular ring having an intake opening on the upstream edge thereof and facing said fuel-air flow, baffle means within said tubular ring to retard the velocity of the fuel and air mixture admitted thereto, the downstream edge of said annular burner secured to the upstream vertex edge of said flame holder, and ignition means in said burner to initiate combustion therein, said ram jet engine comprising a pipe, said piloted flame holder substantially concentrically supported in said combustor pipe.



593 181

1. A piloted flame holder for a ram jet engine comprising an annular flame holder of V-shaped cross-section disposed in a plane normal to the fuel-air flow through said engine and having its vertex pointing upstream of said fuel-air flow, and pilot burner means disposed adjacent to the vertex of said flame holder, said flame holder having an opening at its vertex, said pilot burner discharging a continuous flame into the said holder opening and into the sheltered zone in said flame holder, said pilot burner means comprising an annular tubular ring having an intake opening on the upstream edge of said fuel-air flow, baffle means within said tubular ring to retard the velocity of the fuel and air mixture admitted thereto, the downstream edge of said annular burner secured to the upstream vertex edge of said flame holder, and ignition means in said burner to initiate combustion therein, said ram jet engine having a combustion pipe, said annular burner projecting a continuous annular flame onto said annular flame holder.



593 131

10

5. A ram jet engine having an elongated open end pipe section through which a combustible fuel-air mixture flows, and a plurality of concentric flame holders symmetrically disposed within said pipe in planes normal to the axis of said pipe and said fuel-air stream and having an annular inlet opening, each of said flame holders comprising an annular member being V-shaped in cross-section in a radial plane containing the axis of said pipe section, said annular member having a sheltered zone facing downstream of the fuel air flow and an annular pilot burner aligned with and secured to at least one of the flame holders and constructed in registration with the annular inlet opening of the flame holder whereby to discharge a continuous annular flame directly into the sheltered zone in said flame holder.



593 131

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6. A gas jet engine having an elongated open end pipe section through which a combustible fuel-air mixture flows, and an annular flame holder assembly V-shaped in cross-section in a radial plane containing the axis of said pipe section, said flame holder assembly disposed substantially concentrically within said pipe in a plane normal to the axis of said pipe and said fuel air stream, and having an annular pilot burner secured to the upstream edge of said flame holder, said flame holder having an annular exhaust port and an annular inlet opening, said pilot burner constructed to register with the annular inlet opening of the flame holder whereby to discharge a continuous annular flame directly into the annular sheltered zone in said flame holder.

Ridout and Maybee

111 Richmond St. W.

Toronto 1, Canada

Patent Attorneys of the Applicant